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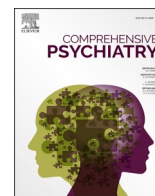
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Effects of an intervention program to improve mental health and epilepsy care in Madagascar

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ABSTRACT

Background: Despite the high prevalence of mental disorders and epilepsy in low- and middle-income countries, nearly 80% of patients are not treated. In Madagascar, initiatives to improve access to epilepsy and mental health care, including public awareness and training of general practitioners (GPs), were carried out between 2013 and 2018. Our study's main objective was to assess the effectiveness of these initiatives, two to five years post-intervention.

Methods: This quasi-experimental study (intervention vs. control areas) included five surveys assessing: general population's Knowledge Attitudes and Practices (KAP), GPs' KAP, number of epilepsy and mental health consultations at different levels of the healthcare system, diagnostic accuracy, and treatments' availability.

Outcomes: In the general population, KAP scores were higher in intervention areas for epilepsy (11.4/20 vs. 10.3/20; $p = 0.003$). For mental disorders, regardless of the area, KAP scores were low, especially for schizophrenia (1.1/20 and 0.1/20). Among GPs, KAP scores were higher in intervention areas for schizophrenia (6.0/10 vs. 4.5/10; $p = 0.008$) and epilepsy (6.9/10 vs. 6.2/10; $p = 0.044$). Overall, there was a greater proportion of mental health and epilepsy consultations in intervention areas (4.5% vs 2.3%). Although low, concordance between GPs' and psychiatrists' diagnoses was higher in intervention areas. There was a greater variety of anti-epileptic and psychotropic medications available in intervention areas.

Interpretation: This research has helped to better understand the effectiveness of initiatives implemented in Madagascar to improve epilepsy and mental health care and to identify barriers which will need to be addressed.

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1. Introduction

Data from the World Health Organization (WHO) and Global Burden of Diseases study (GBD) suggest that about 970 million people across the world suffer from mental disorders and more than 50 million from epilepsy [1–3]. In low- and middle-income countries (LMICs), nearly 80% of patients do not receive treatment [4]. Several factors might lead to this very high treatment gap; there is the lack of knowledge and

understanding of symptoms among the population, combined with strong beliefs and prejudices, which also contribute to the stigmatization of patients [5]. Insufficient human and financial resources also limit access to care [6]. The low number of psychiatrists, neurologists, specialized nurses, psychologists and social workers, and the lack of training for primary care professionals are also among the main barriers to patient care [7]. The availability of basic drugs is particularly low and their price often high. [8]

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In Madagascar, the lifetime prevalence of mental disorders was estimated at 34% among the general population (45.9% in the Antananarivo area), in a door-to-door survey published in 2000 [9]. The most frequent mental disorders were depression, anxiety and alcohol abuse [10]. In 2001, a door-to-door study including 10,379 inhabitants gave a prevalence of 13.5‰ in Ambilobe, in a rural area (Preux, personal data). For epilepsy, Andriantseho reported in 2004 a high prevalence in the capital, estimated at 27 ‰ [11].

The Ministry of Public Health of Madagascar, with the support of Sanofi Global Health, and in collaboration with the World Association of Social Psychiatry carried out an intervention program on mental health and epilepsy. The approach was to develop a community mental health and epilepsy care network through the training of GPs in Primary Health Centers level 2 (PHC-2) and to connect these GPs with the local public hospitals. At the same time, awareness campaigns were conducted to educate patients and their families and to raise community awareness about mental disorders and epilepsy.

The objective of our study was to assess the medium-term effects (i.e. two to five years post-intervention) of the activities implemented by the Ministry of Public Health to improve mental health and epilepsy care in Madagascar.

The specific objectives were to assess:

- the effects of awareness campaigns on the general population,
- the effects of the training on GPs' medical knowledge and practices,
- the effects of the intervention on the number of consultations for mental disorders and epilepsy,
- the availability of psychotropic and anti-epileptic medications in public and private outlets.

2. Methods

2.1. Program overview

The intervention program aimed to develop access to mental health and epilepsy care in five pilot regions out of the 22 of the country (4.38 million inhabitants). This project was carried out over a 5-year period (2013–2018).

During this interventional program, the following activities were implemented [12]:

- Several behaviour change communications (BCC) materials in Malagasy language were developed and disseminated through villages and schools;
- Awareness programs were broadcasted on local radio and TV channels.
- World Mental Health Day was celebrated annually between 2013 and 2017 with information meetings and free consultations being organized,
- 102 GPs working at PHC-2 and local hospitals attended face-to-face training workshops on epilepsy, schizophrenia, mood disorders, anxiety disorders, and addictive disorders, facilitated by specialists practicing at the University Hospital of Antananarivo; these workshops were followed by 149 individualized supervision sessions with a psychiatrist.
- Tuition fees were funded for 44 GPs working in the Public Health System to complete a University Diploma in Mental Health.
- The Congress of the Malagasy Society of Psychiatry was organized annually between 2013 and 2017;

Our study was a quasi-experimental study comparing intervention and control areas.

2.2. Study population

In the general population KAP survey (*survey 1*), participants aged

18 years and over, and residing in the study areas for a minimum period of 6 months prior to the survey, were included. *Survey 2* (KAP of GPs) included GPs working in PHC-2 in both intervention and control areas. All GPs in intervention areas had actively participated in training sessions. In *survey 3*, comparing percentages of consultations for mental disorders and epilepsy in intervention and control areas, patients diagnosed between August 1st and 31st, 2018, with mental disorders or epilepsy by physicians and whose visits were recorded in medical registries, were included. In *survey 4*, evaluating diagnostic accuracy, patients identified with a mental disorder or epilepsy by GPs in the medical centers' registries during the 3 previous months were included. Those who refused to participate, were seriously ill, or unable to speak were not included in these surveys. Caregivers or family members of these patients were present during the surveys. In *survey 5* evaluating the availability of treatment, all types of points of sale (POS) for medicines (public and private) were included. (See Fig. 1)

The sample size calculation and sampling procedures are detailed in Appendix 1.

2.3. Data collection

All 5 surveys were carried-out through structured interviews, using standardized questionnaires. When appropriate, questionnaires included a section on socio-economic variables as well as geographical location (for general population and patients: age, gender, sector of activity, marital status, level of education, number of dependent children; for GPs: type and size of practice, frequency of training received).

For *survey 2*, attitudes of GPs were evaluated via questions asked by a psychiatrist whilst knowledge and practices were assessed through four clinical case studies (on schizophrenia, PTSD, alcohol-related cognitive impairment and epilepsy) with the psychiatrist playing the role of the patient, each interview lasting between 30 and 60 minutes. A KAP score was calculated for each GP based on the answers to the questions and during the role-plays. The scores were checked by an expert, and then a summary score was assigned by disease for diagnosis and management respectively.

In *survey 3*, variables collected were diagnoses recorded in the health centers' registries, as well as diagnoses in the hospital records at discharge.

In *survey 4*, the psychiatrist evaluating the diagnostic accuracy, via interviews with patients, used the Mini-International Neuropsychiatric Interview (MINI) and the IENT questionnaire for epilepsy, both being standardized tools. The IENT questionnaire is a standardized questionnaire designed to assess various aspects related to epilepsy [13,14]. It covers domains such as seizure frequency, medication adherence, treatment satisfaction, and quality of life. The IENT questionnaire aims to provide a reliable instrument for screening patients with epilepsy, describing clinical presentations and forms of epilepsy, investigating potential etiologies, evaluating prescribed treatments. Additionally, this questionnaire has been validated in several studies in low- and middle-income countries [14,15]. For mental disorders, we utilized the MINI questionnaire, specifically the French version 5.0.0, which covers the individual's entire lifespan and adheres to the DSM-IV criteria. This version of the MINI questionnaire has been widely recognized and validated for its reliability and accuracy in diagnosing various mental disorders across different populations. It has been validated in numerous studies in LMICs, particularly in Africa. It has been validated successfully in Ethiopia and Kenya [16], Burkina Faso [17] and South Africa [16,18].

Both *surveys 3 & 4* were based on the International Classification of Diseases 10th Revision (ICD-10) by the World Health Organization (WHO).

In *survey 5*, data were collected through questionnaires about outlets and availability of drugs: private (drug stores and pharmacies) or public outlets, name of the drugs, International Nonproprietary Names (INN), generic/specialty, class.

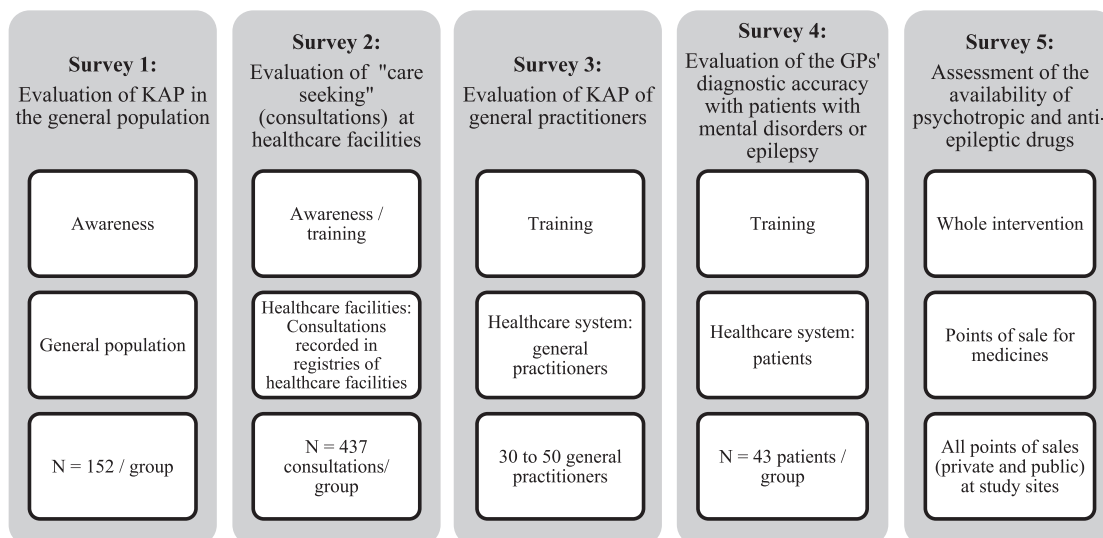


Fig. 1. Overview of the project: quasi-experimental design “here/elsewhere” (intervention vs. control).

2.4. Statistical analysis

A statistical analysis was conducted using STATA 13. For descriptive analysis, qualitative variables were described by using numbers and percentages, and quantitative variables by using means and standard deviation.

Chi-square and Fisher exact tests were used to compare qualitative variables. Student *t*-tests were used to compare means between two independent groups, in intervention and control areas.

A *p*-value ≤0.05 was considered significant throughout the study. Detailed statistical analysis can be found in the protocol in Appendix 1.

2.5. Ethical considerations

The protocol for this study was approved by the National Ethics Committee of the Ministry of Public Health of Madagascar (N^o: 049 MSANP/SG/-AGMED/CNPV/CERBM). All participants were informed about the research and signed a consent form.

2.6. Role of the funding source

Sanofi Global Health was involved in the design of the study, in the interpretation of data and the writing of the manuscript. However academic authors retained full control of data analysis, interpretation and decision to submit the paper for publication.

3. Results

3.1. Socio-demographic characteristics of the surveys' populations

The socio-demographic characteristics of the general population for *study 1* are shown in Table S.1 (Appendix 2). The mean age was 39.4 ± 14.3 years. There was a greater proportion of women regardless of the area (68.1% in intervention areas and 70.8% in control areas). More than 60% of participants had an occupation in the tertiary sector. More than 65% of the respondents were married, and 34% had a middle school level.

The average age of GPs included in *study 2* was 45.7 ± 9.5 years with those in the intervention areas being older than those in the control areas. There were more female physicians with a sex ratio of 0.66. (Appendix 2, Table S.2).

For *study 3*, 30 healthcare facilities were included in total, in both intervention and control areas: two University Hospital Centers (UHC),

13 District Hospital Centers (DHC) or Regional Reference Hospitals (RRH), and 15 PHC-2.

Overall, 32 people with mental disorders and 65 people with epilepsy were recruited in *study 4*. The overall median age for people with mental disorders was 30.5 years and 27.0 for people with epilepsy (Appendix 2; Table S.3). Overall, the sex ratio was 1.

Overall, 264 POS were visited for *survey 5*; 78 (29.5%) were in the public sector and 186 (70.5%) in the private sector. Of these outlets, 218 (82.6%) agreed to participate in the study. The participation rate in the public sector was 94.9% versus 77.4% in the private sector. All details about the outlets visited are presented in Table S.4 (Appendix 3).

3.2. Effects of activities in the general population: KAP in the general population

In the general population, epilepsy KAP scores were significantly higher in intervention areas vs control areas. Epilepsy KAP scores were above 10 and considered acceptable in both intervention and control areas. A higher score was noted for attitudes towards epilepsy compared with knowledge and practices. There was no difference for depression KAP scores between intervention and control areas. Despite better schizophrenia KAP scores in intervention areas, these scores were low for both intervention and control areas (Table 1).

Table 1 Knowledge, attitudes and practices of the general population for each disease.

Sub-scores	Intervention	Control	p-value
	N = 160	N = 168	
	Mean (SD) / 20 points		
Epilepsy	11.4 (3.4)	10.3 (3.5)	0.03 ^a
Knowledge	9.1 (3.0)	8.4 (3.3)	0.003 ^a
Attitudes	14.3 (4.5)	12.8 (4.6)	0.003 ^a
Practices	10.8 (3.9)	9.6 (4.2)	0.01 ^a
Depression	5.4 (6.6)	5.3 (6.6)	>0.9
Knowledge	5.3 (6.5)	5.4 (6.8)	>0.9
Attitudes	5.9 (7.5)	5.8 (7.4)	>0.9
Practices	5.0 (6.3)	4.8 (6.4)	0.7
Schizophrenia	1.1 (3.8)	0.1 (1.3)	0.004 ^b
Knowledge	1.0 (3.4)	0.1 (1.1)	0.004 ^b
Attitudes	1.2 (4.3)	0.2 (1.6)	0.005 ^b
Practices	1.0 (3.8)	0.2 (1.4)	0.005 ^b
Global score	5.9 (1.6)	5.3 (1.1)	0.2

^a Student *t*-test.

^b Wilcoxon-Mann-Whitney test.

3.3. Effects of activities on the health system: mental health and epilepsy consultations at healthcare facilities, KAP of GPs, diagnostic accuracy

3.3.1. Mental health and epilepsy consultations at the various healthcare facilities

Overall, the proportion of mental disorders and epilepsy consultations was higher in the intervention areas than in the control areas (4.5% vs 2.3%); it was the case both for mental disorders and epilepsy, with ratios of 1.8 and 2.3 respectively (Table 2).

At PHC-2 level, the proportion of epilepsy consultations was 2.8 times higher than in control areas, whilst at UHC level, the proportion of mental health consultations was 1.5 times higher (Table 2).

3.3.2. KAP of GPs

The overall score was significantly higher in intervention areas for schizophrenia and epilepsy, but there was no significant difference for PTSD and alcohol-related cognitive impairment. The overall KAP score for GPs was considered as acceptable for schizophrenia, alcohol-related cognitive impairment, and epilepsy.

Concerning the diagnosis sub-score, there was no significant difference for all diseases. However, for the management sub-score, for both schizophrenia and epilepsy, the score was significantly higher in intervention areas (Table 3).

3.3.3. Diagnostic accuracy

For the 32 patients diagnosed with mental disorders by GPs, 21 (65.5%) had mental disorders according to a psychiatrist using the MINI. The level of agreement with the psychiatrist/MINI did not differ significantly between intervention and control areas. Overall, the concordance between GPs' diagnosis and psychiatrists using MINI was only 18.8%. This concordance varied between 28.6% in the intervention areas, and 11.1% in the control areas, without a significant difference (Table 4).

For people with epilepsy, overall, the concordance between GPs' diagnosis and psychiatrists using the IENT questionnaire was 70.1%. This concordance was higher in control areas (80%) than intervention areas (56%) (Table 4).

3.4. Effects of the activities on the availability of anti-epileptic and psychotropic drugs

The overall availability of anti-epileptic drugs was 95.0% (96.0% in intervention areas vs 94.4% in control areas; $P > 0.05$). In other words,

Table 2
Proportion of mental diseases and epilepsy consultations by healthcare facility.

Consultations in each type of healthcare facility	Intervention n (%)	Control n (%)
Total consultations	1927 (100)	2449 (100)
Epilepsy	27 (1.4)	14 (0.6)
Mental disorders	60 (3.1)	43 (1.3)
Other diseases	1840 (95.5)	2392 (96.7)
UHC*	49 (100)	18 (100)
Epilepsy	2 (4.1)	3 (16.7)
Mental disorders	40 (81.6)	10 (55.5)
Other neuropsychiatric diseases	7 (14.3)	5 (27.8)
DHC/RRHC	329 (100)	570 (100)
Epilepsy	4 (1.2)	2 (0.4)
Mental disorders	15 (4.6)	24 (4.2)
Other diseases	310 (94.2)	544 (95.4)
PHC-2	1549 (100)	1861 (100)
Epilepsy	21 (1.4)	9 (0.5)
Mental disorders	5 (0.3)	9 (0.5)
Other diseases	1523 (98.3)	1843 (99.0)
Overall	1927	2449

UHC = University Hospital Center, RRHC = Regional Reference Hospital Center, DHC = District Hospital Center, PHC-2 = Primary Health Center Level 2.

* Neuropsychiatry department.

Table 3
KAP score for GPs for each disease.

Topics	Intervention N = 35	Control N = 48	p-value*
Mean (SD) / 10 points			
Schizophrenia			
Diagnosis	6.7 (3.0)	6.0 (2.9)	0.3
Management	5.4 (4.0)	3.0 (3.3)	0.005
Total	6.0 (2.7)	4.5 (2.2)	0.008
PTSD			
Diagnosis	5.7 (2.2)	4.9 (3.0)	0.2
Management	2.8 (1.9)	2.4 (1.5)	0.4
Total	4.2 (1.6)	3.7 (1.8)	0.1
Alcohol-related cognitive impairment			
Diagnosis	7.4 (2.6)	7.4 (2.7)	0.9
Management	3.1 (2.9)	3.5 (3.1)	0.6
Total	5.3 (1.7)	5.5 (2.1)	0.7
Epilepsy			
Diagnosis	9.5 (1.2)	9.4 (1.3)	0.8
Management	4.2 (2.5)	3.0 (2.1)	0.02
Total	6.9 (1.5)	6.2 (1.3)	0.04

* Student t-test.

Table 4
Diagnostic accuracy (concordance between GPs and psychiatrist with MINI/IENT questionnaire).

	Intervention n (%)	Control n (%)	p-value	Total n (%)
Diagnosis of mental disorders by GPs Vs MINI				
Presence of mental disorders according to MINI	9 (64.3)	12 (66.7)	>0.9 ^a	21 (65.6)
Absence of mental disorders according to MINI	5 (35.7)	6 (33.3)		11 (34.4)
Total	14 (100)	18 (100)		32 (100)
Initial diagnosis of GPs vs diagnosis of psychiatrist using MINI				
Concordant	4 (28.6)	2 (11.1)	0.4 ^a	6 (18.8)
Discordant	10 (71.4)	16 (88.9)		26 (81.2)
Total	14 (100)	18 (100)		32 (100)
Diagnosis of epilepsy by GPs vs diagnosis of psychiatrist using IENT				
Epileptic according to IENT (Concordant)	14 (56.0)	32 (80.0)	0.03 ^b	46 (70.1)
Non-epileptic according to IENT (Discordant)	11 (44.0)	8 (20.0)		19 (29.2)
Total	25 (100)	40 (100)		65 (100)

^a Fisher exact test.

^b Chi² test.

95% of all points of sale stocked at least one AED.

For AEDs, phenobarbital was the most widely available drug in both the public (98.7%) and private sector (86.7%) with no difference between intervention and control areas. Differences were seen with a greater availability in intervention areas for carbamazepine in the public sector (77.4% vs 13.6%; $p < 0.01$) and for sodium valproate in the private sector (46.5% vs 17.0%; $p < 0.01$) (Table 5).

For psychotropic medications, anxiolytics were the only class available in the public sector with no difference between intervention and control areas (93.6% vs 90.9%; $p = 1$). In the private sector, there was a greater availability in intervention areas of antipsychotics (48.8% vs 26.0%; $p < 0.01$), anticholinergic agents (27.9% vs 13.0%; $p < 0.03$), tricyclic antidepressants (46.5% vs 14.0%; $p < 0.01$) and mood stabilizers (6.9% vs 0.0%; $p < 0.02$).

Table 5
Availability of anti-epileptic and psychotropic drugs by sector.

	Intervention n (%)	Control n (%)	p-value	Global n (%)
Anti-epileptic drugs				
Public sector	N = 31 (100)	N = 44 (100)		N = 75 (100)
Carbamazepine	24 (77.4)	6 (13.6)	<0.01 ^a	30 (40.0)
Phenobarbital	30 (96.7)	44 (100)	0.4 ^a	74 (98.7)
Sodium valproate	0 (0.0)	0 (0.0)	–	0 (0.0)
Out of stock	1 (0.0)	0 (0.0)	0.4 ^b	1 (1.3)
Private sector	N = 43 (100)	N = 100 (100)		N = 143 (100)
Carbamazepine	35 (81.4)	71 (71.0)	0.2 ^a	106 (74.1)
Phenobarbital	37 (86.1)	84 (84.0)	0.8 ^a	121 (84.6)
Sodium valproate	20 (46.5)	17 (17.0)	<0.01 ^a	37 (25.9)
Out of stock	2 (4.7)	8 (8.0)	0.7 ^b	10 (7.0)
Psychotropic drugs				
Public sector	N = 31 (100)	N = 44 (100)		N = 75 (100)
Anxiolytics	29 (93.6)	40 (90.9)	1 ^a	69 (92.0)
None	2 (6.4)	4 (9.0)	0.6 ^b	6 (8.0)
Private sector	N = 43 (100)	N = 100 (100)		N = 143 (100)
Anticholinergic agents	12 (27.9)	13 (13.0)	0.03 ^a	25 (17.4)
SSRI antidepressants	4 (9.3)	3 (3.0)	0.2 ^b	7 (4.9)
Tricyclic antidepressants	20 (46.5)	14 (14.0)	<0.01 ^a	34 (23.7)
Anxiolytics	38 (88.3)	87 (87.0)	>0.9 ^b	125 (87.4)
Mood stabilizers	3 (6.9)	0 (0.00)	0.02 ^b	3 (2.1)
Antipsychotics	21 (48.8)	26 (26.0)	<0.01 ^a	47 (32.8)
None	5 (11.6)	12 (12.0)	>0.9 ^a	17 (11.8)
Total of outlets	74	144		218

^a Chi² test.

^b Fisher exact test.

4. Discussion

The goal of the interventional program implemented in Madagascar between 2013 and 2018 was to improve public awareness, to train GPs to improve their knowledge, attitudes and practices regarding mental disorders and epilepsy, and to increase the number of people living with these diseases who would be diagnosed and treated. In the general population, the KAP survey showed significant differences, albeit limited, between intervention and control areas for epilepsy and schizophrenia, but not for depression. KAP scores were higher in intervention areas for epilepsy, particularly for attitudes. Overall, there was also a greater proportion of mental health and epilepsy consultations in intervention areas than in control areas.

According to the WHO, a high percentage of people with mental, neurological, and substance use disorders do not receive adequate treatment and care in LMICs. This is thought to be due to a lack of awareness and understanding of these diseases by the population, as well as limited training leading to poor knowledge and negative attitudes among primary healthcare professionals [19]. In contrast, a 15-year post-intervention evaluation conducted in Ethiopia, showed that negative attitudes towards people with epilepsy in the community remained persistent despite the ongoing supply of AEDs, highlighting the importance of educational programs in the community to eliminate misconceptions and negative attitudes towards epilepsy [20].

In our study, a low level of mental health KAP was detected in the general population, with particularly low scores for schizophrenia. Indeed, Jorm et al. have highlighted gaps in knowledge about prevention, clinical presentation, and treatment among members of the public in several countries [21]. In Lebanon, the proportion of people with a

good level of knowledge about mental health was estimated at about 30% by using *Mental Health Knowledge Schedule* (MASK) [22]. In South Africa, a high proportion of misconceptions about neuropsychiatric disorders has also been identified [23]. In Madagascar, the lack of understanding of these diseases is often exacerbated by strong beliefs with links to religious or supernatural causes [24].

Our KAP survey in the general population showed only limited, if any, differences between intervention and control areas: this could be due to the lack of efficacy of the awareness activities undertaken. The fact that the KAP survey in the general population was carried out between September 2019 and July 2020, up to 6 years after the awareness activities had taken place for some areas, might also have played a role.

For GPs, the overall KAP level was acceptable with relatively high scores for epilepsy. However, despite their interest in mental health, GPs have not necessarily acquired through their initial University training the appropriate skills to diagnose and manage mental health issues and often they have negative attitudes towards mental disorders [25]. In Bolivia, despite a good knowledge regarding the definition of epilepsy, 10% of physicians had never seen a seizure, 22% recognized difficulties in management, and 40% were not satisfied with their initial training [26]. The results of these studies are consistent with those highlighted in our work. Despite the relatively high KAP sub-scores obtained by GPs in the diagnosis sections for the various diseases, physicians struggled when it came to the management of these diseases, with much lower sub-scores in the management sections. A study conducted in Ethiopia, showed that the training of primary healthcare professionals led to an improvement of participants' KAP about psychosis, depression, epilepsy and alcohol use disorders, as assessed immediately and 3-months post-training [27]. Training programs tend to improve healthcare professionals' knowledge in the short term. However, in the long term and without ongoing training support, KAP in mental health and epilepsy might decline. In our study, GPs' KAP scores were assessed between September 2019 and July 2020, while some of the training sessions took place as early as 2014 for some areas. Therefore, it would be important to provide ongoing training support to physicians to keep improving their skills over time.

Concerning mental health and epilepsy consultations, our study suggests that the majority of epilepsy consultations occurred at PHC-2 level, mostly located in rural areas, distant from hospitals. Conversely, the majority of mental disorders were treated in hospitals. Our study also showed higher proportions of consultations in intervention areas than in control areas for epilepsy at the PHC-2 level, and for mental disorders at the UHC level. Despite the improvements suggested in our study between intervention and control areas, studies previously conducted in Madagascar have shown significant treatment gaps. For epilepsy it has been estimated at 92% by an indirect method (based on drug use during the year) and 32% by a direct method (based on the number of cases detected not receiving treatment in a prevalence study) [28–30]. For mental disorders, it has been shown in Madagascar that patients and their families tend to go first to religious or traditional healers in 42.5% of the cases, prior to seeking help from a healthcare professional [31]. The higher proportion of epilepsy consultations in the intervention areas might suggest a greater confidence of GPs in diagnosing and managing epilepsy.

Our study showed that agreement between diagnoses made by GPs for patients seen at PHC-2 level and diagnoses made by psychiatrists using the MINI questionnaire was very low. Even though very low, the diagnosis concordance between GPs and psychiatrist for mental disorders was higher in intervention areas than in control areas. For epilepsy, a significant difference was found with a better concordance with the IENT questionnaire in the control areas. In order to avoid misdiagnosis, it is essential to understand the causes and to take adequate measures to prevent them. The majority of errors that occur during the diagnosis process are often caused by cognitive biases, also influenced by systemic causes (communication, teamwork ...) [32,33]. It would be important to support GPs with practical and innovative tools to enable them to

provide adequate care to patients. These recommendations must take into account the creation of a mental health register as well as any applicable guidelines or management processes at the PHC-2 level. However, these proposals must be discussed with the Ministry of Health during the program's scaling up.

The availability of AEDs as a therapeutic class was high in the 218 outlets surveyed in our study in Madagascar. Over 90% of the points of sale had at least one AED in stock, both in the intervention and control areas. This was superior to previous studies in Madagascar (>80.0%) [34], as well as in Vietnam (>30.0%) [35], Thailand (>80.0%) [36], and Laos (21.1%) [37].

There was a greater variety of AEDs in private pharmacies than in public outlets, with greater availability of carbamazepine and sodium valproate in private points of sale. Similarly, in the study conducted in Madagascar by Jost et al. public hospitals' pharmacies had a limited choice of AEDs, with greater availability shown in private pharmacies [8].

The availability of psychotropic drugs was very low in public pharmacies, with anxiolytics being the only therapeutic class available. In private pharmacies, the various classes of psychotropic medications could be found, and the availability of antipsychotics, tricyclic antidepressants, mood stabilizers and anticholinergic agents, although below 50%, was better in intervention areas than in control areas. Although the interventional program didn't include any activities regarding the supply of medications, it is possible that, with demand driving supply, the higher volume of mental health consultations in intervention areas had a positive impact on the availability of psychiatric medications.

To our knowledge, this research is the only study evaluating the effects of community-level interventions to improve epilepsy and mental health care in Madagascar. This quasi-experimental design with intervention and control groups allowed a comparison between these two groups to assess the program's effect. It evaluated a broad range of indicators (general population's KAP, GPs' KAP, proportion of mental health and epilepsy consultations, diagnostic accuracy, treatment availability) in order to better grasp the various effects of the intervention. However, our study is not without limitations. Firstly, a before/after comparison was not possible which limited the evaluation of the direct effect of the various activities. Furthermore, interrater and intrarater reproducibility was not performed for the validation of KAP scales. The timing of our study is another limitation: in some cases, surveys were conducted up to seven years after some of the training and awareness activities had taken place. This could result in several biases: dilution of the effect when surveying GPs and the general population so long after the training or awareness sessions, and during that time, other factors or activities could have influenced the results (even if this is mitigated using a control area). Finally, regarding survey 4, evaluating diagnostic accuracy, the minimum sample size was not reached, as there were too few patients identified with a mental disorder or epilepsy by GPs in the medical centers' registries during the 3 previous months. The Covid pandemic resulted in various lockdowns and travel restrictions, leading to many delays and constraints impacting the implementation of this study.

5. Conclusion

This study has helped to better understand the effects of the mental health and epilepsy community activities implemented by the Ministry of Public Health between 2013 and 2018: it has highlighted potential barriers which will have to be addressed. The introduction of new diagnosis and management practices seems to be a priority for the Ministry of Public Health. For this reason, a study about KAPs of health students (medicine, pharmacy and nursing) in their final year of theoretical training is being conducted to identify gaps in their academic studies in order to improve their basic knowledge and skills. In addition, further analysis of the availability and accessibility of anti-epileptics and psychotropic drugs in Madagascar will be necessary as a further step to

reduce the treatment gap.

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Contributors

All authors contributed to the design of this study and to its conduct. SM and FB coordinated field implementation and data acquisition. DG oversaw all control processes for diagnostic accuracy and professional evaluation. SM, PMP and FB performed data and statistical analyses. All authors were involved in the data interpretation. SM, LM and PEB drafted the first version of the publication. All authors revised it critically for important intellectual content. All authors had full access to study data and had final responsibility for the decision to submit for publication.

CRedit authorship contribution statement

Sedera Mioramalala: Conceptualization, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Lara Mroueh:** Formal analysis, Investigation, Writing – original draft, Conceptualization. **Pierre-Emile Bruand:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Mbolatiana Michèle Raharinivo:** Conceptualization, Methodology, Writing – review & editing. **Roger Marie Rafanomezantsoa:** Conceptualization, Visualization, Writing – review & editing. **Daniel Gérard:** Conceptualization, Data curation, Validation, Writing – review & editing. **Arsène Ratsimbaso:** Conceptualization, Investigation, Methodology, Visualization, Writing – review & editing. **Pierre-Marie Preux:** Conceptualization, Investigation, Methodology, Supervision, Writing – review & editing. **Farid Boumédiène:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Validation, Writing – original draft, Writing – review & editing.

Declaration of competing interest

PEB and DG are former Sanofi employees and own Sanofi shares. SM, LM, FB, PMP report grants or personal fees received either directly or indirectly from Sanofi Global Health in the context of the submitted work. FB and PMP report grants from Sanofi Global Health outside the submitted work.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.comppsy.2024.152484>.

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